LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: **Cowskin Creek**
Water Quality Impairment: Nutrients and Oxygen Demand Impact on Aquatic Life

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Middle Arkansas–Slate **County:** Sedgwick

HUC 8: 11030013

HUC 11 (HUC 14s)**:** **010** (010, 020, 030, 040)

Drainage Area: 189.4 square miles

Main Stem Segments: 12, 13, 14; starting at the confluence with the Big Slough River; Headwaters near Andale, in Sedgwick County.

Tributary Segments: Big Slough (11)
Dry Creek (15)
Dry Creek (16)

Designated Uses: Expected Aquatic Life Support; Primary Contact Recreation; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply Use; Irrigation Use; Livestock Watering Use for Main Stem Segments

1998 303d Listing: Table 2–Stream Segments Identified by Biological Monitoring

Impaired Use: Expected Aquatic Life Support on Main Stem Segments.

Water Quality Standard: Nutrients--Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

Cowskin Creek TMDL Reference Map

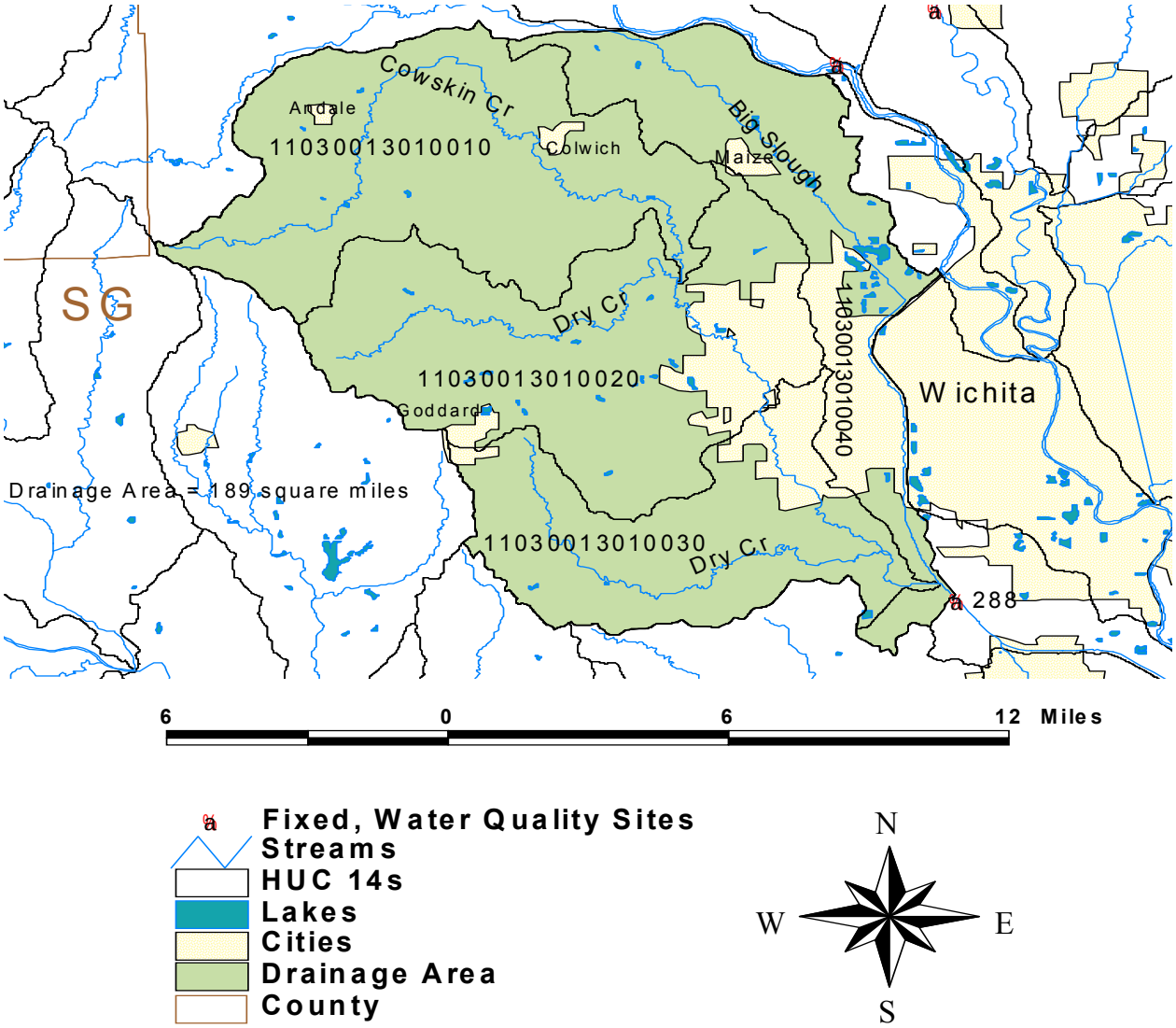

Figure 1

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303d: Partially Supporting

Monitoring Sites: Station 288 in Wichita–Valley Center

Period of Record Used: 1980 to 1999

Flow Record: The flow at Cowskin Creek was calculated by using the flow at Slate Creek near Wellington (USGS Station 07145700; 1968 to present year)

Flow Conditions: Average Flow = 66.5 cfs, Median Flow = 7.6 cfs**,** 7Q10 = 1 cfs

Current Conditions:

Parameter	Historical Average & Range (1980 - 1999) for biological data
Macroinvertebrate Biotic Index (MBI)	4.56 (3.97 -5.61)
% Ephemeroptera, Plecoptera, and Trichoptera (EPT) Taxa (Count)	43 % (12 - 62 %)
Biochemical Oxygen Demand (BOD)	4.69 mg/L (1.00 - 27.3 mg/L)
Phosphorus	333 ug/L (40 - 1,300 ug/L)
Ammonia	85 ug/L (20 - 710 ug/L)
Nitrate	650 ug/L (10 - 1,540 ug/L)
Total Suspended Solids	103 mg/l (3 - 1040 mg/l)

Three main parameters (MBI, %EPT, and BOD) were analyzed to address the nutrient/ oxygen demand impairment. The Macroinvertebrate Biotic Index rates the nutrient and oxygen demanding pollution tolerance of large taxonomic groups (order and family). Higher values indicate greater pollution tolerances. Along with the number of individuals within a rated group, a single index value is computed which characterizes the overall tolerance of the community. The higher the index value the more tolerant the community is of organic pollution exerting oxygen demands in the stream setting. Index values greater than 5.4 are indicative of non-support of the aquatic life use; values between 4.51 and 5.39 are indicative of partial support and values at or below 4.5 indicate full support of the aquatic life use.

The EPT index is the proportion of aquatic taxa present within a stream belonging to pollution intolerant orders; Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies). Higher percentages of total taxa comprising these three groups indicate less pollutant stress and better water quality.

On this stream segment, the average MBI value indicates that aquatic life support is partially impaired (MBI between 4.51 and 5.39). Fifty percent of the surveys resulted in MBI values over 4.5, and the other half were under 4.5. Average MBI under partial support conditions was 4.86;

average MBI under full support conditions was 4.26. When aquatic life is partially impaired, the percentage of EPT taxa ranges from 12 - 54% (39% average). Under full support conditions, the percentage averages 48%. The historical average of BOD (4.7 mg/L) is slightly above normal background levels (3 - 4 mg/L).
Phosphorus, ammonia, and nitrate were graphed against the flow. In the phosphorus graph, the nutrient concentration increased with increased flow, which suggests that phosphorus is being transported into the stream segments during high runoff events. The nitrate and ammonia concentrations were independent of flow. Overall, the average concentration of nutrients in the Cowskin Creek watershed tends to be lower (333 ug/L phosphorus, 85 ug/L ammonia, and 650 ug/L nitrate) than surrounding biological monitoring sites.

Comparison of Biological Index Values and Average Nutrient and Sediment Concentrations

Station	MBI	Total P	Nitrate	Ammonia	BOD	TSS
Great Bend	5.45	1.13 mg/l	1.3 mg/l	1.0 mg/l	6.1 mg/l	106 mg/l
Valley Center	4.67	0.80 mg/l	0.95 mg/l	0.16 mg/l	4.6 mg/l	127 mg/l
Derby	5.15	0.80 mg/l	1.86 mg/l	0.70 mg/l	6.5 mg/l	98 mg/l
Ark City	4.81	0.73 mg/l	1.37 mg/l	0.15 mg/l	6.6 mg/l	153 mg/l
Cowskin	**4.56**	**0.33 mg/l**	**0.65 mg/l**	**0.085 mg/l**	**4.7 mg/l**	**103 mg/l**

Antecedent nutrient and BOD levels were examined for the four months prior to each biological sampling. No relationship between nutrient levels and resulting MBI value could be discerned. The elevated MBI is therefore believed to be a combination of factors. Some of the factors could include: nutrients, sediment, pesticides and dissolved oxygen. Other aspects of ecological health of the stream relate to the physical conditions of the stream segments as measured through such indices as the Habitat Development Index (HDI). This index considers such conditions as the substrate availability, riparian vegetation cover and flow. The HDI will also be assessed during future monitoring concurrently with MBI determinations.

Desired Endpoint for Cowskin Creek for 2005 - 2009

The use of biological indices allows assessment of the cumulative impacts of dynamic water quality on aquatic communities present within the stream. As such, these index values serve as a baseline of biological health of the stream. Sampling occurs during open water season (April to November) within the aquatic stage of the life cycle of the macroinvertebrates. As such there is no described seasonal variation of the desired endpoint of this TMDL. The endpoint would be average MBI value of 4.5 or less over 2005-2009.

Achievement of this endpoint would be indicative of full support of the aquatic life use in the stream reach. While the narrative water quality standard pertaining to nutrients is utilized by this TMDL, there is no direct linkage between MBI values and nutrient levels. A number of factors may contribute to the occasional excursion in index values above 4.5. These include flows,

adequate habitat and stream modifications. The link between MBI values and nutrient levels on Cowskin Creek remains qualitative at this phase of the TMDL.

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: There are five NPDES permitted wastewater dischargers located within the watershed (four lagoons and one activated sludge plant).

MUNICIPALITY	STREAM REACH	SEGMENT	DESIGN FLOW	EXPIRATION DATE
ANDALE WWTP	COWSKIN CR	14	0.08 MGD	2002
COLWICH WWTP	COWSKIN CR	14	0.187 MGD	2002
GODDARD MWWTP	UNNAMED TRIB to DRY CR	15	0..3 MGD	2002
HIGH PLAINS CORP COLWICH REV.	UNNAMED TRIB to COWSKIN CR	14	0.25 MGD	2002
MAIZE MWWTP	BIG SLOUGH	11	0.5 MGD	2002

Population projections indicate some moderate growth for Andale (17.4%), Colwich (25.6%), Goddard (15.2%), Maize (29.2%), and Wichita (15.9%) to the year 2020. Goddard MWWTP is expanding its three lagoon system with an additional fourth. A new waste treatment plant, Northwest Wichita WWTP No. 3, is anticipated to open in 2002. This facility will discharge into Cowskin Creek (segment 14) and has a design flow of 2 MGD. At its ultimate development, the facility will be able to treat nutrients in its effluent. Plans call for nitrification and de-nitrification processes and biological phosphorus removal with filtration.

Andale, Colwich and Goddard all have standard permit limits for BOD (30 mg/l) and TSS (80 mg/l). High Plains and Maize have those limits as well as seasonal ammonia limits. Given the lack of relationship between nutrient levels and MBI values, implications for these point sources to the impairment are not clear.

Livestock Waste Management Systems: Thirty-seven operations are permitted within the north and west portions of the watershed, accounting for a potential of up to 10,022 animal units. A majority of those operations are dairy (23). There are nine cattle, one sheep, three swine, and one swine/chickens LM operations in the Cowskin Creek watershed. All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed for the 25 year, 24 hour rainfall/runoff event, which would be indicative of flow durations well under 10 percent of the time. The actual number of animal units on site is variable, but typically less than permitted numbers. Many of the facilities may be located adjacent to the stream segments with a higher susceptibility to runoff.

Land Use: Most of the watershed is cropland (78%). Ten percent is urban, and ten percent is grassland. In 1998, 47,335 tons of fertilizer were bought in Sedgwick County. Nineteen percent of Sedgwick county lies within the watershed. Assuming an even distribution, about 8,970 tons of fertilizer were bought and used in the watershed in 1998.

Grazing density of livestock is moderate (27.4 animal units per square mile) throughout the watershed. In 1997, inventories of milk cows, sheep, cattle, and swine were as follows:

County	# of Milk Cows	# of Sheep	# of Cattle	# of Swine
Sedgwick	5,900	400	47,900	5,500
Cowskin Ck. Watershed	1,118	76	9,077	1,042

On-Site Waste Systems: A number of residents within Sedgwick County are in rural settings without sewer service, relying instead on on-site waste systems. Failing septic systems contribute nutrient loadings. The sporadic conditions of partial support and the near-full support condition overall seem to indicate a lack of persistent loadings from such systems on any grand scale. However, population projections for the Sedgwick County indicate substantial growth in rural population to the year 2020, suggesting that proliferation of on-site systems will be occurring in the watershed. Construction of the Northwest Wichita WWTP #3 may bring service to unsewered areas in the northern and eastern drainage of Cowskin Creek, thereby reducing this potential source.

Contributing Runoff: The watershed has an average soil permeability of 1.9 inches/hour according to NRCS STATSGO data base. Runoff would be produced under storms ranging in duration from one to six hours, having a recurrence interval of five, ten or twenty five years. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. Generally, 90 percent of the watershed would generate runoff under dryer conditions. Moderate or wet conditions (larger storms) would see runoff contributed from 98 percent of the watershed.

Background Levels: Most of the woodland in the watershed is adjacent to Cowskin Creek and Dry Creek. Leaf litter falls into the streams and decomposes increasing the oxygen demand. Small amounts of phosphorus are contributed from the watershed soils. Nitrogen loads may be contributed from the atmosphere.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

There is a direct, yet unquantified relation between nutrient loading and impaired biological integrity. Decreased loads should result in aquatic communities which are indicative of improved water quality. The ability of biological data to integrate the various physical and chemical impacts of the entire watershed on the aquatic community defies allocation of specific nutrient loads between point and nonpoint sources. Additionally, no specific relationship between the observed ambient nutrient levels and the biological impairment indicated by the MBI value could be established. Because biological integrity is a function of multiple factors, the initial pollution load reduction responsibility will be to decrease the average condition of nutrients and sediment over the range of flows encountered on Cowskin Creek. Future monitoring will be designed to uncover the actual reasons for the impairment and this TMDL will be adjusted to reflect the new information.

For this phase of the TMDL, an average condition is considered across the seasons, to establish

goals of the endpoint and desired reductions. Therefore, average ambient levels are multiplied by the average flow estimated for Cowskin Creek. This is represented graphically by the integrated area under each load duration curve established by this TMDL. The area is segregated into allocated areas assigned to point sources (WLA) and nonpoint sources (LA). Future growth in wasteloads should be offset by reductions in the loads contributed by nonpoint sources. This offset along with appropriate limitations should eliminate the impairment. This TMDL represents the "Best Professional Judgment" as to the expected relationship between these sources and the expected MBI score.

Point Sources: There is one proposed and five existing facilities potentially releasing effluent into the watershed, and reaching the monitoring site. The existing loads contributed by these facilities are unknown and will need to be determined in the future through monitoring of effluent and ambient receiving streamflow. Assuming the total effluent volume arrives at the monitoring site, that flow (5.1 cfs) would constitute a flow which was exceeded 65% of the time on Cowskin Creek. Therefore, the allocation for point sources is demarcated by the area under each respective load duration curve bounded from 65% to 100%. At this stage of the TMDL, the assumed condition is maintenance of current conditions at those low flows, presuming an offset of lower non-point loading at higher flows. The Wasteload Allocation represents the load in the stream which the point sources contribute. In most cases, this is a function of permit limits and plant performance; in the case of nutrients and BOD, there is some assimilation and degradation of the constituents in transit while flowing downstream. Further refinement of this allocation will come with information on effluent concentrations and developed nutrient criteria for streams, resulting in specific permit limits in the second stage of this TMDL.

The Wasteload Allocations represent the average load which the treatment plants can be expected to discharge. This allocation accounts for the 2 MGD of the proposed Wichita WWTP #3. Because of the detention time of effluent leaving the plants before entering the creek, actual concentrations are likely to be lower than the general condition described by the Wasteload Allocation. Furthermore, the instream assimilation or degradation of the organic or nutrient parameters in transit will result in lower actual ambient concentrations at low flow at the monitoring site than that suggested by this allocation. Furthermore, biological processes transform available nitrogen into nitrate and ammonia forms in a dynamic fashion, therefore, both species should be considered in total when assessing potential reduction in nitrogen loading to the stream.

The Wasteload Allocations under this TMDL apply at the downstream monitoring site and reflect the average ambient conditions seen below the point sources under low flow conditions. Actual loadings by the point sources at their outfalls are much greater, but again because of the assimilation and degradation of the nutrient or organic pollutants imposed by the biological processes of the stream and watershed, resulting downstream loads decrease substantially. The attached Appendix provides the calculations affirming that upstream loads decrease to lower ambient loads at the downstream monitoring location. Estimating the current loadings by the five existing point sources and comparing those loads to the resulting downstream loads indicates that phosphorus decreases by 89%, available nitrogen by 82% and BOD by 82%. Additionally, Streeter-Phelps analysis indicates that no oxygen sags resulting from current or future BOD loadings will cause stream dissolved oxygen levels to fall below 5 mg/l.

Nonpoint Sources: Given the runoff characteristics of the watershed, overland runoff can easily carry sediment, phosphorus and nitrogen from the watershed into the stream reaches. The composition of the watershed indicates a mixture of rural and urban nonpoint sources which may contribute to the downstream impairment. These sources tend to become dominant under higher flow conditions. Therefore, the area under the load duration curves bounded from 1-65% constitutes the Load Allocation for this TMDL. Because of the predominant loads under runoff conditions, this Load Allocation intends to reduce loadings such that ambient levels for phosphorus are below 300 ppb in stream, nitrate below 0.6 ppm, ammonia below 0.08 ppm, BOD below 4 ppm and sediment concentrations average below 100 ppm in the stream.

First Stage TMDL Goals and Gross Allocations for Cowskin Creek

	MBI	TOT. PHOSP	POT. AVAIL. NITROGEN	BOD	TSS
CURRENT	4.56	118.5 #/D	262 #/D	1688 #/D	36,987 #/D
REDUCTION	0.06	10.8 #/D	15 #/D	252 #/D	1,077 #/D
TMDL	4.50	107.7 #/D	247 #/D	1436 #/D	35,910 #/D
WLA		9.1 #/D	20 #/D	129 #/D	2,750 #/D
L.A.		98.6 #/D	227 #/D	1307 #/D	33,160 #/D

Defined Margin of Safety: Given the variable nature of the MBI values seen on this stream, additional biological measures are necessary to assure indications of good aquatic community health. Therefore, the defined Margin of Safety for this TMDL will be a proportion of EPT individuals making up at least 55% of the sample population when MBI values are 4.5 or lower. This will ensure that the majority of aquatic macroinvertebrate population is composed of pollution intolerant taxa. This measure may also correlate with the availability of adequate habitat in the stream to support such a community.

State Water Plan Implementation Priority: Because Cowskin Creek is in a mixed rural-urban setting, subject to increased pressure of development and because Cowskin Creek is a major tributary to the Arkansas River below Wichita, this TMDL will be a High Priority for implementation. While additional monitoring, source assessment and definition of the relationship between aquatic community response and nutrient loading are studied in anticipation of numeric nutrient criteria to be developed over the next five years, the emphasis of this TMDL will be the nonpoint contributions of sediment and nutrients in the watershed.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Middle Arkansas–Slate Subbasin (HUC 8: 11030013) with a priority ranking of 6 (Highest Priority for restoration work).

Priority HUC 11s and Stream Segments: The north and west portions of the Cowskin drainage should be the priority focus of implementation most agricultural production with opportunities for BMP installation is in that location. Segments 12, 13, 14 constitute the main streams which reflect biological impacts from watershed activities.

5. IMPLEMENTATION

Desired Implementation Activities

1. Implement necessary soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain necessary conservation tillage and contour farming to minimize cropland erosion.
3. Install necessary grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Install proper manure storage.
6. Implement necessary nutrient management plans to manage manure application to land.
7. Monitor wastewater discharges for excessive nutrient loadings.

Implementation Programs Guidance

NPDES - KDHE

a. Monitor effluent from wastewater systems to determine their nutrient contributions and ambient concentrations of receiving streams.
b. Ensure proper monitoring, permitting, and operations of municipal wastewater systems to limit nutrient and BOD discharges after numeric criteria are established.
c. Ensure plans for the northwest Wichita WWTP #3 allow for ultimate installation of nutrient treatment technologies.

Nonpoint Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management.
b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
c. Provide technical assistance on nutrient management in vicinity of streams.
d. Assist evaluation of stormwater quality from urbanized areas of watershed.

Technical Services - KDHE

a. Incorporate numeric nutrient criteria into water quality standards after final EPA nutrient criteria guidance is issued.

Environmental Field Services - KDHE

a. Work with Department of Wildlife and Parks and the City of Wichita to assess stream habitat and other factors impacting the aquatic community throughout Cowskin Creek.

Local Environmental Protection Program - KDHE

a. Support inspection of on-site wastewater systems to minimize nutrient loadings

Water Resource Cost Share & Non-Point Source Pollution Control Programs - SCC

a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.

b. Provide sediment control practices to minimize erosion and sediment and nutrient transport

Riparian Protection Program - SCC

a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
b. Develop riparian restoration projects
c. Promote wetland construction to assimilate nutrient loadings

Buffer Initiative Program - SCC

a. Install grass buffer strips near streams.
b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

Extension Outreach and Technical Assistance - Kansas State University

a. Educate agricultural producers on sediment, nutrient and pasture management
b. Provide technical assistance on buffer strip design and minimizing cropland runoff
c. Encourage annual soil testing to determine capacity of field to hold phosphorus

Time Frame for Implementation: The first stage directs pollutant reduction practices should be installed within the priority subwatersheds during the years 2001-2005, with minor follow up implementation, including other subwatersheds over 2005-2009. To some degree, reduction practices associated with reducing bacteria impairment will have an impact on reducing nutrient loads to the stream. Monitoring of wastewater and receiving stream quality should commence with the renewal of permits.

The second stage involves incorporating refined allocations and load reductions including permit limits which should be in place after final EPA guidance has established numeric criteria and those criteria have been incorporated into Kansas water quality standards.

Targeted Participants: Primary participants for initial implementation will likely be agricultural producers operating within the drainage of the priority subwatershed. Initial work over 2001-2005 should include an inventory of activities in those areas with greatest potential to impact the stream, including, within a mile of the stream:

1. Total rowcrop acreage
2. Cultivation alongside stream
3. Fields with manure applications
4. On-site wastewater discharges to stream
5. Condition of riparian areas
6. Presence of livestock along stream
7. Uncontrolled entry points for urban runoff

Some inventory of local needs should be conducted in 2001 - 2005 to identify such activities. Such an inventory would be done by local program managers with appropriate assistance by commodity representatives and state program staff in order to direct state assistance programs to

the principal activities influencing the quality of the streams in the watershed during the implementation period of this TMDL.

Municipal point sources will initiate monitoring and subsequently treat effluent to reduce nutrient loading once EPA guidance and numeric criteria are in place. Some assessment of stormwater quality coming from urbanized areas of the watershed will be needed to direct any appropriate stormwater management practices.

Milestone for 2005: The year 2005 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, adequate source assessment should be complete which allows an allocation of resources to responsible activities contributing to the nutrient impairment. Additionally, biological data from Cowskin Creek over 2001-2005 should not indicate trends of reduced support of the aquatic community. Numeric nutrient criteria should be established by 2005 and sampled data from Cowskin Creek should indicate evidence of reduced nutrient levels relative to the conditions seen over 1985-1999.

Delivery Agents: The primary delivery agents for program participation will be KDHE permitting programs working with the point source dischargers, particularly the City of Wichita, the Sedgwick County conservation district for programs of the State Conservation Commission, and the Natural Resources Conservation Service. Producer outreach and awareness will be delivered by Kansas State Extension and agricultural interest groups such as Kansas Farm Bureau and Kansas Livestock Association and grain crop associations. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for Sedgwick County.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.

2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

3. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.

4. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.

5. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

6. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.

7. The *Kansas Water Plan* and the Lower Arkansas Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding: The State Water Plan Fund annually generates $16-18 million and is the primary funding mechanism for implementing water quality protection and pollution reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are a **High Priority** consideration. Priority should be given to activities which reduce loadings of bacteria and nutrients to the stream prior to 2005.

Effectiveness: Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming and waste management within the watersheds cited in this TMDL.

Technology exists for nitrogen and phosphorus removal and can be placed in wastewater systems with proper planning and design.

Should voluntary participation significantly lag below expectations over the implementation period or monitoring indicates lack of progress in improving water quality conditions from those seen over 1990-1999, the state may employ more stringent regulations on nonpoint sources in the watershed through establishment of a Critical Water Quality Management Area in order to meet the desired endpoints expressed in this TMDL.

6. MONITORING

As numeric nutrient criteria become established, KDHE will continue to collect seasonal biological samples from Cowskin Creek for at least three years over 2001 - 2005 and an additional three years over 2005-2009 to evaluate achievement of the desired endpoint. Monitoring of nutrient content of wastewater discharged from treatment systems will be expected under new and reissued NPDES and state permits, including ambient monitoring above and below the facilities.

Further MBI and HDI sampling sites may be established to address conditions throughout the reach segments 12, 13 and 14.

Additional source assessment needs to be conducted and local program management needs to identify its targeted participants of state assistance programs for implementing this TMDL. This information should be collected in 2000-2004 in order to support appropriate implementation projects and corrective actions.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Lower Arkansas Basin were held March 9, 2000 and April 26-27, 2000 in Wichita, Hutchinson, Arkansas City and Medicine Lodge. An active Internet Web site was established at http://www.kdhe.state.ks.us/tmdl/ to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Lower Arkansas Basin.

Public Hearing: A Public Hearing on the TMDLs of the Lower Arkansas Basin was held in Wichita on June 1, 2000.

Basin Advisory Committee: The Lower Arkansas Basin Advisory Committee met to discuss the TMDLs in the basin on September 27, 1999, November 8, 1999, January 13, 2000, March 9, 2000 and June 1, 2000.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:

Sedgwick County Technical Advisory Group: August 8, October 14, November 15, 1999 and January 20, 2000.
City of Wichita: August 25, 1999, November 15, 1999, February 9, 2000, February 24, 2000 and May 5, 2000.
Agriculture: January 12, February 2 and 29, 2000
Environmental: March 9, 2000
Conservation Districts: November 22, 1999
Industry: December 15, 1999, January 13, February 9 and 22, 2000
Local Environmental Protection Groups: September 30, November 2, December 16, 1999

Milestone Evaluation: In 2005, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of Cowskin Creek. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed. The second stage of this TMDL is anticipated to begin after 2005 with the adoption of numeric criteria in water quality standards.

Consideration for 303d Delisting: The river will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303d list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2002 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2001-2005.

APPENDIX

CALCULATIONS OF UPSTREAM LOADS RELATIVE TO DOWNSTREAM AMBIENT CONCENTRATIONS

Estimated Existing Loads

Source	Volume	Phosphorus	Nitrogen	BOD
Andale	0.08 MGD	2.7 #/D	2.1#/D	16.7 #/D
Colwich	0.187 MGD	6.2 #/D	4.9 #/D	39.1#/D
Goddard	0.30 MGD	10.0 #/D	15.0 #/D	62.7 #/D
High Plains	0.25 MGD	8.3 #/D	6.5 #/D	52.2 #/D
Maize	0.50 MGD	4.2 #/D	13.0 #/D	104.5 #/D
Total	1.31 MGD	31.4 #/D	41.4#/D	275.2 #/D

Phosphorus assumes 4 mg/l for all but Maize; 1 mg/l for Maize
Nitrogen assumes 1 mg/l Nitrate for all; 2.1 mg/l Ammonia for all but Goddard; 5 mg/l for Goddard
BOD assumes 25 mg/l for all

Assuming effluent discharge reaches downstream monitoring site, resulting flow would be 2.04 cfs, exceeded 78% of time.

Average ambient loads at 2.04 cfs are; 3.5 #/D P, 7.8 #/D N and 50 #/D BOD, reflecting average concentrations of 0.33 mg/l P, 0.73 mg/l N and 4.7 mg/l BOD

Ratio of downstream load to upstream loads is: 0.11 P; 0.19 N; 0.18 BOD

Wichita WWTP #3 adds 2 MGD (3.09 cfs); resulting downstream flow is 5.13 cfs, exceeded 65% of time.

Average ambient loads at 5.13 cfs are: 9.1 #/D P; 20.2 #/D N and 129 #/D BOD, again reflecting the same ambient average concentrations

Additional incremental load at 5.13 cfs beyond current loading would be: 5.6 #/D P; 12.4 #/D N and 79#/D BOD (determined by subtraction of loads at 2.04 cfs from those of 5.13 cfs

Resulting upstream loads found by dividing incremental loads by ratios: 50.9 #/D P; 66#/D N and 439 #/D BOD

Approved August 9, 2000.